

ABSTRACT

A waveform-adaptive ultra-wideband (UWB) transmitter and noise-tracking UWB receiver for use in communications, object detection and radar applications. In one embodiment, the output of an oscillator is gated by a low-level impulse generator either directly or through an optional filter. In a special case of that embodiment wherein the oscillator is zero frequency and outputs a DC bias, a low-level impulse generator impulse-excites a bandpass filter to produce an UWB signal having an adjustable center frequency and desired bandwidth based on a characteristic of the filter. In another embodiment, the low-level impulse signal is approximated by a time-gated continuous-wave oscillator to produce an extremely wide bandwidth pulse with deterministic center frequency and bandwidth characteristics. The low-level impulse signal can be generated digitally. The UWB signal may be modulated to carry data, or may be used in object detection or ranging applications. The power amplifier may be gated to provide a power-efficient UWB transmitter. The UWB transmitter exhibits well defined and controllable spectral characteristics. The UWB transmitter is capable of extremely high pulse repetition frequencies (PRFs) and data rates in the hundreds of megabits per second or more, frequency agility on a pulse-to-pulse basis allowing frequency hopping if desired, and extensibility from below HF to millimeter wave frequencies.